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THE CONCEPT OF "NETWORK" IN THE SYSTEM OF BASIC CONCEPTS OF REGIONAL ECONOMIC GEOGRAPHY

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The concept of "network" is traditionally used in sociological and economic sciences and serves as an in important object of research on the organisational forms of different phenomena and processes. This article examines the use of the "network" concept in socioeconomic geography through identifying the place of this concept in the system of traditional concepts of this branch of geography: spatial system, territorial production complex, and cluster. The interaction between networks on a certain territory at a certain stage of its development comprises the framework of a region as a complex socioeconomic territorial system. The author examines economic networks as organic systems characterised by resistance to external effects and comprised of interconnected economic agents from one or several related industries. A concentration of strong connections within such network constitutes its core or a cluster. Based on a retrospective analysis of studies into the spatial organisation of economy, it is concluded that there is a need to examine network forms from the perspective of regional socioeconomic geography in the context of managerial decision-making. The regional economic geographical approach to studying network forms of spatial organisation makes it possible to take into account not only the organisational features of the network itself, but also their connections to the related contextual conditions. It is an integrated approach, thus, it makes it possible to forecast the development of a certain network form in case of a change in the conditions or factors affecting it.

Key words: spatial system, economic network, cluster

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Studies of networks and network organisation forms are rather popular and develop within social and economic sciences. Since the mid-1960s-1970s, this form of cooperation has become the focus of both sociological and economic sciences. One of the founding fathers of the network approach in sociology is R.M. Emerson [23; 29], who developed a social exchange theory with studying exchange networks. In economics, the first attempt to examine network forms of cooperation was made in the framework of the holarchic approach proposed by A. Koestler [33].

Later, a network became the object of study of various natural sciences and the humanities thus generating many different definitions of the concept *network*. However, it is difficult to select a single definition [4; 7]. It is more productive to analyze general characteristics of network organisation forms. A network is a localised structured system of interconnected elements, between which resources are distributed. This distribution is regulated by a set of formalised and non-formalised rules. In sociology, elements of networks are individuals, in economics — economic agents.

As sociology and economics began to focus on networks, Russian and international socioeconomic geography was developing a new approach to the study of territorial organisation forms. This approach is aimed to identify and study territorial and socioeconomic systems of different spatial levels [2; 15; 17]. One of the first influential economic geographical concept was François Perroux's concept of growth poles developed in the 1950s and based on Erik Dahmén's idea of development blocks [24]. According to Perroux, growth poles are concentrations of innovative enterprises generating the propulsive effect alongside the whole production chain within a certain industry [37]. This approach to spatial development of economy has found wide application in the sectoral policy since the second half of the 20th century.

Walter Isard's concept of industrial complexes based on the idea of locational interdependence between industries has been developing in economic geography since the 1960s [32, p. 377]. Isard believes that all economic activities are interrelated to a degree. However, when identifying industrial complexes, weak interrelations can justifiably be ignored [32, p. 378]. This approach was supported by Stanislaw Czamanski and Daniel Z. Czamanski [25, pp. 93—94] and Victor Prochnik [40, p. 15], who consider industrial complexes as a "group" or "block" of such industries that are connected to each other through the flows of goods and services stronger than to the others.

As early as the 1980s, cross-industry connections were considered as a positive factor for the development of the existing network forms of

spatial organisation, for instance, industrial districts. A.L. Saxeian [41; 42] emphasises that the formation of cross-industry and interorganisation connections beyond the value chain could have a positive effect on overcoming crises phenomena that affected the Silicon Valley companies in the 1970s. It is worth noting that, almost until the end of the 1980s, scholars consider the Silicon Valley as an industrial district. Later, under the influence of the works by M.E. Porter [38] and M.J. Enright [30], it was defined as a cluster.

When developing his concept of clusters, Porter considered a cluster as an alternative way of organising the value chain. He defines a cluster as a group of related and complementary industries exhibiting different types of connections, including horizontal ones (for instance demand, supply, skills, institutions, and technology) [27]. In Russia, the concept of regional clusters is based on the idea of territorial production complexes (TPCs) developed by the Soviet economic geographer N.N. Kolosovsky [11]. However, these concepts show significant dissimilarities explained by the differences between the planned and market economies, which is discussed in detail by I.V. Polipenko [13], T.R. Gareev [9], and V.P. Sidorov and N.P. Shamaeva [16]. In general, these differences seem to lie in the fact that horizontal connections take precedence in Western regional science and vertical ones in Soviet economic geography and regional economy.

An analysis of works on spatial socioeconomic systems and their economic types shows that such systems are network forms of organising interactions between industries within a certain geographic space. Therefore, it is possible to state that a network as a form of spatial organisation is also a classical object of study of socioeconomic geography, whereas the basic concepts of this branch of science (territorial socioeconomic system, region, territorial production complex, industrial district) denote types of networks developing in certain geographical conditions. In economic geography, the economic types of networks of different spatial level are traditionally referred to as clusters, social networks as territorial social systems [18], and complex networks as socioeconomic system (districts or regions).

E.B. Alaev defines a network as “a group of objects of the same type brought together by the structuredness of their distribution within a certain territory (from the perspective of regularity and density). As one can expect, objects comprising a network belong to the same element of a landscape or a district [1, p. 55].

Unlike other sciences studying networks in ‘laboratory’ conditions and focusing on the internal structure, composition, and analysis of the intensity

and hierarchy of ties between elements, socioeconomic geography studies certain forms of network organisation in certain spatial conditions, while also focusing on the interaction between networks and the environmental component. This makes studies in socioeconomic geography more practice-oriented; they are aimed at solving certain problems at a certain spatial level (from the local to the mega level). An economic geographical perspective suggests the inseparability of a network from its context — a certain set of factors and conditions that affect the formation and functioning of a network. Changes in the context inevitably change the network. To predict changes in a network form of spatial organisation, it is necessary to understand what factors and to what degree affect its elements. The answer to this question is of great practical significance in making managerial decisions at all hierarchical levels.

Earlier, we considered the features of network development in Russian domestic trade and conducted a comparative analysis of the Baltic region as to the level and rates of retail development [3].

A structural and functional classification of networks includes the following types:

— economic networks (production, infrastructural, and innovative ones);
— ekistic networks;
— social networks;
— information networks;
— institutional networks;
— political networks.

Firstly, economic networks include network elements, i.e. economic agents from one or several related industries and, secondly, stable substantial connections between elements. These organic systems are resistant to external effects and react to these effects as an integral whole. Below, we will consider economic networks proceeding from the fact that their functioning is determined by the presence of the above networks, whereas the interaction of networks of different types on a certain territory at a certain stage of its development creates the framework of a region as a complex socioeconomic territorial system.

As mentioned above, any network consists of nodes and ties between them, which ensure the movement of different resources. In an economic network, these nodes are represented by enterprises, their groups, industries, and even clusters — another type of the network organisation form. The interaction of individual nodes in space develops connections between them. By density, connections can be weak and strong (table 1).

Table 1

Comparative characteristics of weak and strong ties in a network

Hierarchical level	Strong ties	Weak ties
individuals and groups of individuals	develop between people constantly involved in interactions due to their cultural, territorial, or other proximity	rare or one-time contacts between people belonging to different strong tie groups
level of companies	contract relations of mutual dependence, long-term cooperation, investment in relational capital, development of informal cooperation	impersonalised "producer — consumer" contract relations, one-time clearly formulated contracts, a lack of trust relationship, developed competition
level of industries	stable connections between industries based on the long-term interdependence of a large number of companies within the industry, constant exchange of resources, synergy effects	connections between industries are almost absent; single interactions between several companies of one industry with companies of another industry are possible; a lack of resource complementarity

Strong ties remain stable over the time and are characterised by the interdependence of interacting elements. The concentration of strong ties within a network forms its core, a cluster. According to M.E. Porter, the borders of a cluster are formed by the existing strong ties between companies (horizontal, vertical, and structural ones) [14]. It is worth noting that cluster borders rarely correspond to those suggested by standard industrial classification systems [38, p. 18]. In reality, networks of interactions develop between companies from different industries. According to Porter, in this sense, an industry is not a relative unit of analysis because of the numerous cross-industry connections within a cluster [10, p. 16]. Thus, groups of interdependent industries started to be considered by scholars as a regional cluster [26]. A regional cluster is different from an industry because it represents the entire value chain from suppliers to end products, including supporting services and specialised infrastructure. A (regional) cluster is geographically concentrated and interconnected by the flow of goods and services within the competences of the actors that remain open to the economy [43]. Sporadic and non-systemic weak ties develop the belt of a cluster's external connections, being located beyond its border (fig. 1).

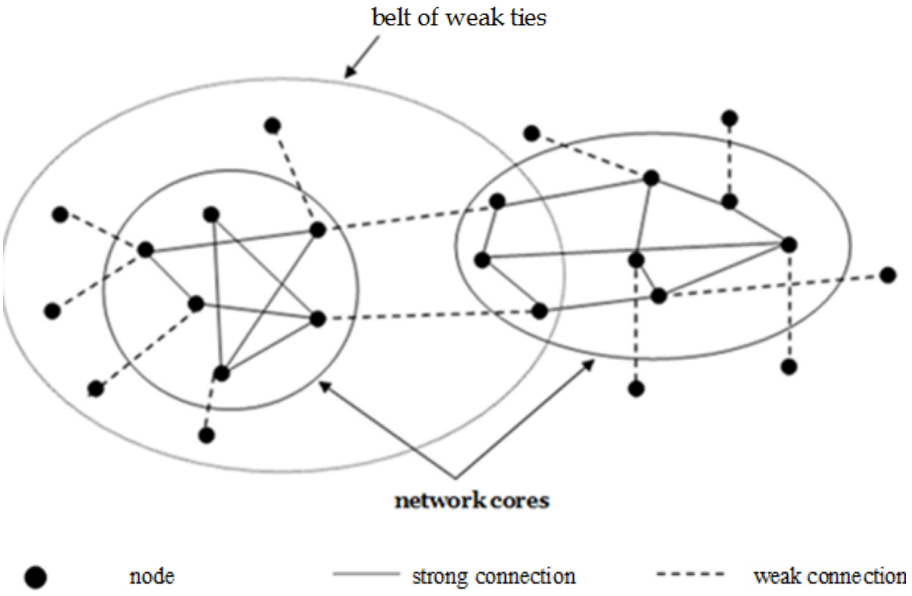

Fig. 1. Structure of the network form of spatial organisation

According to Mark Granovetter, only weak ties may be local bridges between network cores. The disintegration of local bridges can result in the isolation of cores and a significant increase in the 'distance' of interaction, which results in additional costs. The larger the number of weak ties, the higher the density of network elements in the core and their ability to act as an integral whole to ensure general competitiveness [12]. The findings of numerous studies show that the examination of clusters as an internal interaction network places significant limitations on the actual picture and distorts it. According to [20; 21; 22; 31; 34; 35], the dependence of the core on external weak ties and the fuzziness of its borders make scholars focus on interactions beyond the industrial specialisation of key nodes. In this context, forecasting the development of certain forms of network organisation of space requires the identification of a set of factors (institutional, social, economic and geographical, cultural, historical, and other ones) affecting both strong and weak ties. However, the problem of their high dynamism arises in this case.

The mobility of ties between industries results in that the value chains change their configurations creating, according to J. Schumpeter, "new combinations" [19]. Completely new industrial value chains develop or the existing ones undergo radical reconfiguration. As a rule, this process results in the formation of new network forms and even new industries. The understanding of where and how ties emerge in a network is the key aspect of developing an efficient regional policy. Moreover, clusters — being the centres

of regional economic activities of interdependent industries — make it possible to observe such changes [36].

The first studies aimed to identify cross-industry network ties at a national level were carried out in 2000 by the US Institute for Strategy and Competitiveness at Harvard Business School under the supervision of M.E. Porter. Despite the fact that the methodology was largely based on the expert evaluation method, in 2005, it was adjusted to meet the needs of EU statistics by the Centre for Strategy and Competitiveness at the Stockholm School of Economics. It was also used in the research of the European Cluster Observatory carried out since 2007 under the supervision of Ch. Ketels. Until today, European studies have used the so-called cluster categories, i.e. groups of cross-industry ties identified in the US and adjusted to the European NACE classification system. In 2014, the European Cluster Observatory concluded a major research project focused on cluster categories. It identified ten emerging industries in the EU economy (table 2).

Table 2

New industries in the EU economy identified by the European Cluster Observatory in 2012 and 2014

2012	2014
creative (communications equipment and services; marketing, design, and publishing; music and sound recording; performing arts; printing services; video production and sales)	creative industries
eco (power generation and transmission; environmental services)	ecotechnology
experience (hospitality and tourism; performing arts)	entertainment industry
maritime (power generation and transmission; fishing and fishing products; water transportation)	"blue growth" industries
mobile (communications equipment and services; plastics)	digital industry
	modern packaging
mobility (aerospace vehicles and defence, automotive communications equipment and services, electric power generation and transmission, information technology and analytical instruments, transportation and logistics)	mobility technology
	logistics
personalised medicine (biopharmaceuticals, insurance services)	biopharmaceuticals
	medical devices

Source: [36]

Overall, scholars from the USA and EU have identified 51 cluster categories; each of these categories consists of at least 15 interdependent types of export-oriented economic activities. The minimum number of activities in a category is three (the "tobacco" group, which brings together the production of cigarettes and other tobacco products and tobacco leaf processing). The maximum number of activities is 62 (the "distribution and electronic commerce" group including wholesale of clothing and food, chemical products, gases, equipment, etc.; electronic commerce, packaging and labelling services, renting and leasing of equipment) [26]. It is worth noting that studies into cross-industry ties aimed at identifying cluster categories were carried out at the regional level, which ensured the efficiency of the expert evaluation method.

In Russia, information about such studies is unavailable, therefore, it is impossible to obtain data on certain regional and cluster categories (cross-industry ties), whereas *regional cluster* is considered as a synonym of *industry*. Moreover, the diversified environmental and climate conditions, a rich resource base, high potential for import substitution, developed infrastructure, and effective human resources make it possible to speak of Russian cluster categories, which differ structurally from those identified in the USA and EU.

Conclusions

1. The regional economic-geographical approach to studying network forms of spatial organisation makes it possible to take into account not only the organisational features of the network itself, but also their connection to the contextual conditions, in which it is embedded. Since it is an integral approach, it is possible to forecast the development of a certain network form in the case of a change in the conditions or factors affecting it.

2. Of crucial importance is the nature of interactions between a network's elements. As a rule, actual network forms combine strong and weak ties. The concentration of interdependent elements with strong ties forms the core of a network or a cluster. The resource flows between clusters take place through the local bridges of weak ties.

3. A regional cluster as a territorially localised network is a group of interdependent economic agents, which can belong to the same type of economic activities (single industry cluster) and several interdependent types (cross-industry clusters). New stable combinations of activities generate new cross-industry cluster. Changes in the ties between individual activities and industries are a result of a combination of external and internal factors (institutional, economic and geographical, social, cultural, historical, and other ones).

4. The economic geographical research on clusters (both single industry and regional ones) makes it possible to study both internal ties between economic agents and external ties with different territorially localised factors — economic, environmental, ekistic, social, and institutional ones, etc. (i.e. ties with other territorial socioeconomic systems.

5. Assuming that the factors affecting the ties within the network core are internal and those affecting the belt of weak ties external, one can conclude that the correlation and nature of the impact of external and internal factors will change in a long-term perspective as a result of the emergence of new combinations (fig. 2). When forecasting the dynamics of a certain network form of spatial organisation, one should take into account the effect of both internal and external factors on strong and weak ties between different economic activities comprising a territorial localised cross-industry network — a regional cluster.

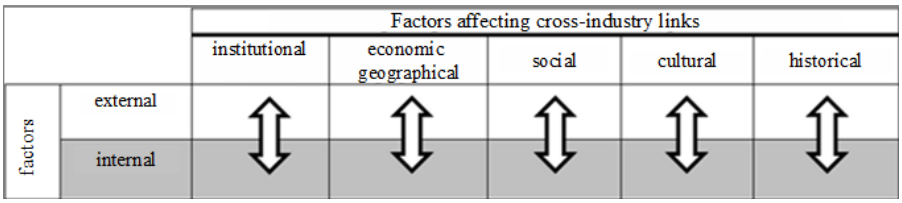

Fig. 2. Correlation between external and internal factors affecting cross-industry ties in a regional cluster

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